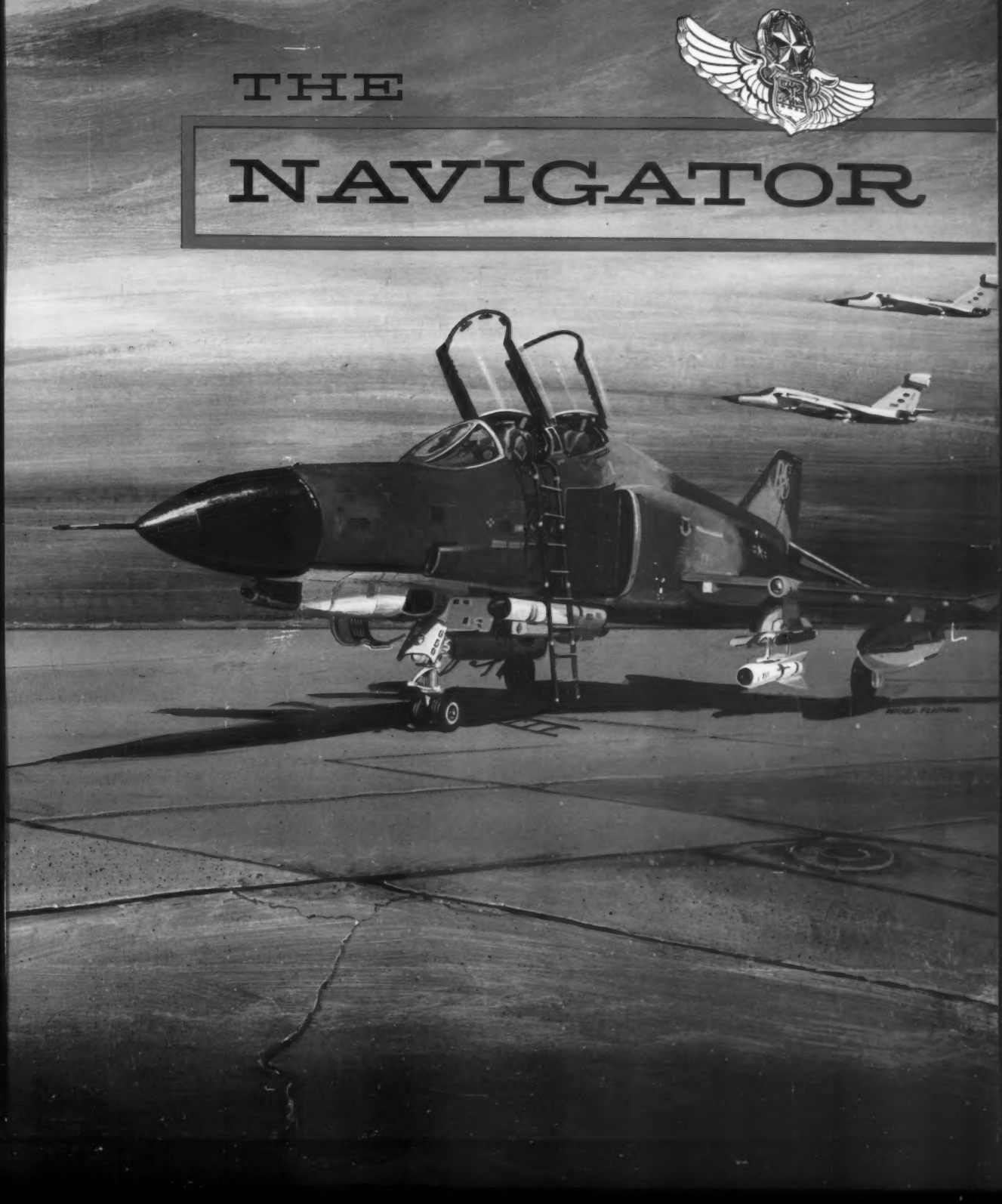
AFRP 50-3, Volume XXVIII, Number 3, Winter 1981

THE NAVIGATOR



NAV OF NOTE

Colonel Richard D. Paul is the Commander of the 323d Flying Training Wing, Mather AFB, California. His unit is responsible for training navigators for the U.S. Air Force, Navy and Marines. The 323d trains Electronic Warfare Officers and Navigator Bombardiers, as well as navigators from over 20 foreign nations. Also, Colonel Paul is responsible for support of a number of Mather tenants including SAC's 320th Bomb Wing and the 940th Air Refueling Group (Res).

A 1957 graduate of Boston University, Colonel Paul entered the Air Force through the ROTC program. He attended navigator training at Harlingen AFB, Texas, and received his wings in 1958. After completing nav school, Colonel Paul's first assignment was with the 54th Weather Reconnaissance Squadron, (WRS) Anderson AFB, Guam. "I felt very strongly about contributing something to my country, and I chose to serve in the Air Force through the ROTC program. From the beginning, I was a navigator candidate and I set some very definite goals for myself. At first, these included such things as becoming a regular officer, and making captain. In those days, it sometimes took up to 7 years to make captain, but fortunately this time had just been reduced when I became eligible, and I was among the first to make it after 4-1/2 years. Up until then, I had planned to leave the Air Force when my ROTC commitment was up." From Guam, Colonel Paul moved to Japan with the 56 WRS, and from that point, "Things began to break my way, my wife and I enjoyed the Air Force life, and I never again considered leaving the service."

In 1962, Colonel Paul was assigned to the 38th Military Airlift Wing at McGuire AFB, New Jersey, flying the C-118. Later he joined the initial cadre of the 40th Military Airlift Squadron flying C-135s. "I have always felt that the Air Force mission is vital to our nation, and I feel great about what we are doing. In my early flying assignments, as well as now, I came to work extremely motivated and charged up, eager to get to the business at hand."

Selected as an instructor at Squadron Officer School in 1964, Colonel Paul later became an aide to the Commander of the Air University. In 1968, he was assigned to Headquarters, US Air Force, as Assistant Executive Officer to the then DCS for Personnel (now Manpower & Personnel).

In 1969, he moved within the Pentagon to the Foreign Liaison Division, Office of the Vice Chief of Staff, as a Political Military Affairs Officer. "The following year I volunteered for combat flying and wound up in O-2s, flying night missions along the Ho Chi Minh trail, serving as a forward air controller. That was a highly interesting experience, for it gave me a look at the tactical side of the navigator's role."

Colonel Paul was transferred to CCK Air Base, Republic of China, in 1971, and served as the Executive Officer for the Commander, 374th Tactical Airlift Wing. "I was beginning to think that most of my career would be spent as an exec. After the CCK assignment, I was transferred to Scott AFB, and became the Executive Officer for the Director of War Plans, HQ MAC. I also served as the Chief of the Training and Military Education Division at MAC, but in 1975, it was back to the Executive Officer role at Lackland, where I became the Recruiting Service Commander's exec."

Assigned as Vice Commander of the Basic Military Training School at Lackland in 1979, Colonel Paul became Commander later that same year. "I wanted very much to become Commander of Basic Military Training, and I set my sights on that job. To attain that goal, I tried to make myself the

most knowledgeable individual in the Air Force about Basic Military Training. It was a great job, and I wanted the opportunity to be the commander. I had been in the Air Force 21 years and had tried every way I could think of for numerous commander's jobs that became available everywhere I'd been stationed. I never could get one, for a variety of reasons, mostly because I was an executive officer, and my boss wouldn't let me go."

In July 1981, however, Colonel Paul attained one of the most highly prized flying command jobs in the Air Force—Commander of Mather's 323d Flying Training Wing. He views this as a very vital, challenging and extremely interesting assignment. "My goal is to produce the very finest officers and navigators we can during navigator training. I believe that one's first commitment is to be the best officer possible. The technical specialities—in this case, navigator skills—are extremely important, but without the firm foundation of good officership, the other things just won't be there. We have made some changes in the program. For example, my wife and I get involved with the students and their families. We meet each new class, get to know the individuals, their needs, wants and goals. I also tell them what we have to offer, mainly the chance to become the best officers and the finest navigators in the world. I want to 'fine tune' the training program here, to further improve its quality. We do a good job; it's a lot better than when I went through nav school. We're going to continue those efforts, and continue to get the job done in the best possible manner." Colonel Paul believes that the future is bright for navigators, but that individuals must take the initiative and seek opportunities. "My personal standard is excellence," he says. "I don't settle for anything less and I don't expect anyone in my organization to. To me, the term 'satisfactory' is undefined—it just doesn't exist. Anything less than excellent means we have a lot of hard work left."

Colonel Paul has some definite ideas about the role of the navigator, and the quality of the nav force. "I want to improve the visibility and image of Air Force navigators. As a navigator, I believe that too few people understand what a navigator is, and the important role that navigators play. I feel it is my responsibility to do some things to actively recruit people to become navigators. This is a great career field, and we can point with pride to a number of people we have in the nav force, and THE NAVIGATOR magazine does a good job at that. I firmly believe that the only navs who have a cap on their career are those who think of themselves as 'just a navigator.' If you think of yourself as the best officer in the United States Air Force, and work hard at the jobs you are given, then your career opportunities are limitless."

FROM THE EDITOR

Once again, the enthusiasm and resourcefulness of our readers have enabled us to put together an informative, interesting issue. We have a variety of articles, including an eagerly awaited WSO feature and a look at the EF-111A. Major General Keith D. McCartney, one of the Air Force's senior ranking navigators, graciously consented to an interview, and his remarks appear on page 9. Several technical features are included in this issue, and perhaps the information contained therein might help you the next time you're overwater. The second part of Star Identification is presented on page 18, and we have received a number of good comments on this feature. Several organizations have requested reprint rights, and many navs find this information extremely useful. The final installment, part three, will appear in the next issue.

Without the fine support rendered by the readers, this magazine could not exist. THE NAVIGATOR magazine staff relies completely on material submitted by you, and we are grateful for the outstanding contributions made. This is YOUR magazine, and it is the only forum for information exchange among practicing navigators. If you have an idea for an article, or if you would like to write something but are having trouble getting started, give us a call or drop a line. We are only too happy to offer any assistance we can. There is a tremendous amount of writing talent available in the Air Force nav community, and THE NAVIGATOR magazine is an excellent outlet for that talent.

AFRP 50-3, Volume XXVIII, Number 3, Winter 1981

Department of the Air Force

THE NAVIGATOR

Proudly Serving Air Force Navigators Around the World Since 1953

SECRETARY OF THE AIR FORCE
HON GEORGE V. ORR, JR.

COMMANDER AIR TRAINING COMMAND
GEN THOMAS M. RYAN, JR.

COMMANDER 323D FLYING TRAINING WING
COL RICHARD D. PAUL

Editorial Staff

EDITOR
CAPT WALTER W. WOODRUFF

ACTING PRODUCTION AND ART EDITOR
DERREL A. FLEENER

ASSOCIATE EDITOR
PATRICIA R. PALMER

ADMINISTRATIVE SPECIALIST
SSGT MARGARET S. AIKINS

Published triannually with funds approved by Headquarters, United States Air Force. Distributed through the Air Force Publication Distribution Center in accordance with Air Force Regulations.

Manuscript contributions are welcomed, as are comments and criticisms. Contact the Editor at the address below or at (916) 364-2138 or AUTOVON 828-2138 before extracting from or reprinting material. Opinions expressed by individual contributors do not necessarily reflect the official viewpoint of the Department of the Air Force.

Address manuscripts to Editor, THE NAVIGATOR magazine, 323 FTW/DOTN, Mather Air Force Base CA 95655. Address subscriptions to Superintendent of Documents, GPO, Washington DC 20402; yearly $7.50 domestic, $9.40 foreign; single copy $2.75 domestic, $3.45 foreign. Air Force Recurring Publication 50-3.

Authority to publish this periodical automatically expires on 29 January 1982 unless continuance is authorized by the approving authority prior to that date.

CONTENTS

Nav of Note 2

From the Editor 3

WSO Command Opportunity in the 80's 5

The Noonday Tropical Latitude Fix 7

An Interview with Major General McCartney 9

The Inertial Rendezvous 13

The F-94 15

The EF-111A 18

Star Identification, Part II 21

NAVIGRAMS 25

PLOP by Temperature 26

THE NAVIGATOR Five Year Index 29

Command opportunity for "fightergators" is examined on the following page. Some of the fighter aircraft are featured on the cover.

For an interesting insight by one of our senior navigators, see page 9.

AFRP 50-3

Distribution: One copy per two navigators.

WSO Command Opportunity in the '80s

Captain Joseph H. WEHRLE, Jr.
AFMPC/MRCROR2
Randolph AFB, TX

Everyone sets goals. Whether it be short or long term, the establishment and achievement of a goal provides career direction and personal incentive, both of which are vital to a true sense of accomplishment. In the Air Force work environment, goal setting is especially important. At the outset of their careers, most officers set a long-term goal as a future supervisor or commander —usually connected directly to their area of expertise.

Before 1975, the navigator was one of the few Air Force officers who could not aspire to a supervisory position in his own specialty. By law, flying command positions were reserved for pilots, a fact-of-life restriction which helped create and perpetuate "second-class citizen" feelings among navigators. When Title 10 was revised in 1975, many pilots weren't ready for it—but neither were the navigators. In this article, I'd like to look at one group of navigators, the Weapon Systems Officer (WSO) and how their attitude and command opportunity has changed since 1975.

The WSO career field, as we know it today, really began to develop in the late 1960s when the Air Force, faced with a shortage of fighter pilots, elected to place navigators in the rear seat of front-line fighter aircraft. Except for a few instances, this new fighter WSO was the first contact that the average fighter pilot had with a navigator. Thus, the professional aviator-to-aviator bonds we know today did not develop overnight. However, the process was clearly accelerated by the decision to man the initial cadre of WSOs with experienced navigators. Competence gained in other weapons systems had assured a steep learning curve and the respect that went with it. Later, the F-4 became UNT acceptable and the force began to grow to meet the expanding requirement in Southeast Asia.

Caught up in the pace and intensity of Rolling Thunder, Linebacker I and II, these first WSOs—now called fightergators—discovered that navigation per se was only a small part of getting the bomb or missile on target. They also had to become experts in RHAW/ECM, weapons, tactics, aircraft systems and many pilot procedures. As with any other group, some WSOs performed well and some did not. Those that did well and settled comfortably into the fighter mold were, unfortunately, still faced with the traditional single path to long-term career success—get out of the cockpit and behind the

desk as soon as and for as long as possible. This game plan didn't sit well with most fighter WSOs for the simple reason that they enjoyed fighter ops but knew they couldn't stay there and expect a future job opportunity commensurate with their rank. The young WSO had a hard time accepting the fact that he had to leave his primary duty at mid-career and search for an alternate path for advancement.

When Title 10 changed, the reaction was mixed. Most young WSOs (myself included) were overanxious and expected rapid changes in the command structure. Most senior WSOs were leery—many considered it a change in regulation and not in attitude. Most young two-seat fighter pilots were glad to see the change—many older pilots stuck with their past beliefs. All in all, a wise man would have recognized that changes would occur—but very slowly. WSOs would have to prove their command potential and would have to grow into positions of increased command responsibility. Except in rare instances, selecting a squadron commander with no previous command background was too much of a risk for any major command to accept.

Since 1975, WSOs have made substantial progress in the area of command opportunity. Even as the number of available two-seat cockpits begins to reduce, the total number of WSOs holding command positions has held steady and, in most cases, increased. (See Figures 1 and 2.)

The primary reason for the success depicted in the chart is the WSO himself. He has shown the rest of the fighter community that he can do the job. He does not expect to get the job simply because of a regulation change. He gets it because he's the most qualified aviator for that job.

Fighter command structure differs a bit from some of the other weapons systems —initial command supervision begins with the flight commander. In the normal two-seat squadron, he supervises 10 - 12 aircrew members and is in the direct chain of command between them and the squadron operations officer. But, the flight commander job is the important first stepping-stone to more senior command opportunity in fighter operations. As the future two-seat fighter requirement stabilizes, the 70-plus WSO flight commanders we have now will impact on the number of WSOs who become future operations officers and commanders.

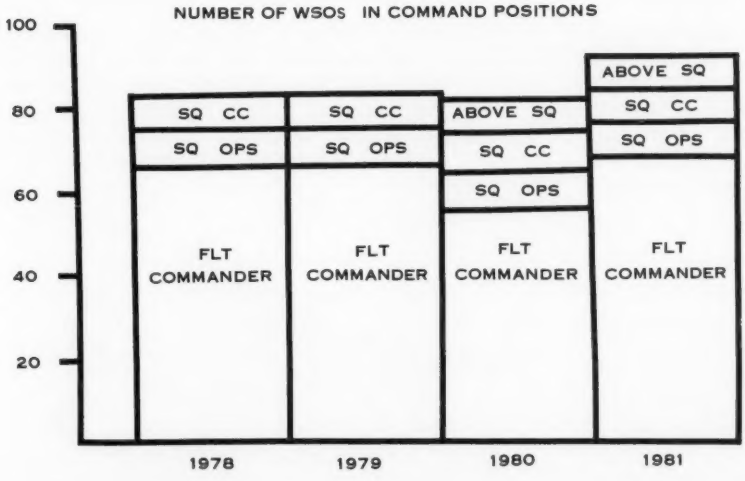


FIG 1

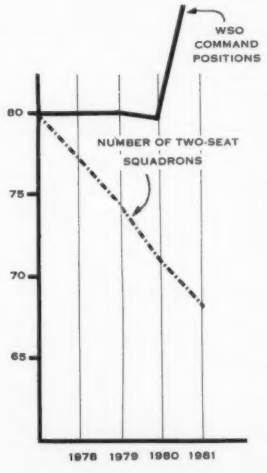


FIG 2

In fighter operations, other duties are now open to WSOs due to the Title 10 change. Range Control Officer, Runway Supervisory Officer, and the Wing Supervisor of Flying, although sometimes not as appealing as flight commander and operations officer jobs, are also necessary stepping-stones for future command. To be ready to step up to tough command decisions is difficult enough—to respond correctly under pressure is impossible without experience.

Command isn't for everyone. We all like to think of ourselves as future leaders but there's only room for a handful of operational commanders and the competition is tough. It's going to take the stand-out performer with a proven background to compete well.

With the WSO inventory improving a bit, most of the senior WSOs without flying gate problems who are now returning to the cockpit are volunteers. They have the operations background and experience to compete and they are increasingly confident that they'll get a fair shot. As the WSOs have proven in the past, a highly successful career in duties other than operations is both possible and rewarding. But, for those of you who have set a fighter commander's job as your goal, the time is ripe and the opportunity is there. Don't rationalize your goal away—go for it!

Capt Wehrle graduated from the US Military Academy in 1970. He completed UNT and F-4 training before assignment to Clark AB. Next came assignments to Eglin AFB, Osan AB, and Hill AFB. Since 1978, Capt Wehrle has been assigned to HQ AFMPC, Randolph.

Captain Dale A. SMITH
28 AREFS
Ellsworth AFB, SD

When I attended Undergraduate Navigator Training a few years ago, the celestial LOP was described as a portion of an equal altitude circle scribed around the subpoint of the observed celestial body. It was constructed by drawing a tangent to this circle perpendicular to the azimuth. This azimuth, or ZN, was drawn towards the celestial bodies' subpoint.

In Nav school, we were taught to compute an LOP by determining the elevation from a point on the Earth and then, using the sextant's information, decide whether we were towards or away from that assumed point. As students we accepted this and found that it worked because we were over North America and the celestial bodies' subpoints were all located thousands of miles away.

As one gets closer to the subpoint of the Sun, the theory of celestial navigation remains the same but the technique changes. One can no longer

assume that the ZN from assumed positions will remain constant. Graphic construction becomes difficult as one approaches the subpoint of the body because the LOP becomes a portion of a finite circle and is no longer just a "straight line." Being too close to the subpoint of a night celestial body does not present a problem, since the HO 249, Vol I, uses stars with subpoints located a considerable distance away. However, near local noon in the tropics, where the only celestial body available might be the Sun, this noonday fixing technique may be the only means available for a position.

The one shortcoming of this noonday fix is that you cannot obtain a heading check. Instead, you must assume that your compass is reliable (it should have been checked earlier in the flight) as part of the fix will be determined using information from the compass.

You may decide to use this method if your in-flight DR falls within a reasonable distance, say 300 nm, of the Sun's subpoint. This could be ascertained by performing a conventional precomp and finding an Hc of greater than 85°-00', or by noting the subpoint of the Sun on the chart at fix time and then measuring the distance between subpoint and DR.

You don't need the HO 249, Vol II, to perform the noonday precomp. The subpoint of the Sun at fix time becomes the assumed position (see Fig 1). Equating the Air Almanac information to latitude and longitude, the declination equals latitude and the GHA equals longitude (if GHA is greater than 180°, then longitude is east and is

CELESTIAL PRECOMPUTATION

HO-249 PRECOMPUTATION - PERISCOPIC SEXTANT

NAVIGATOR	Capt Johnny LaRue	ALT MSL	31000	DATE (Z)	1 July 1980
				FIX TIME	2220
TRACK	235°	BODY	☉		
GS	420 K	BASE GHA	154-02		
CORIOLIS	2 L	CORR			
PREC/NUT	1	SHA			
DR LAT	24-38 S	GHA	154-02		
DR LONG	156-55 W	ASSUM LONG	154-02		
LHA					
ASSUM LAT			23-03		
DEC			23-03 S		
PLANNED TIME					
ACTUAL TIME			2220		
TAB Hc					
CORR					
Hc			90-00		
TOTAL → A ADJ					
ADJ Hc					
OFF TIME MOTION					
Ho			87-12		
INT			168 T		
Zn/GZn (-)	122		122		
TH/GH	235		302		
DRB	113				
SRB	113				
Zn/GZn (+)	122				
TH/GH	235				
T/C TRACK					
Zn					
REL Zn					

REFRACTION TABLE (Condensed)

ALTITUDE MSL (Thousands of Feet)

CONV ∠ ANGLE - E

GRID Zn

TIME | TH/GH | GYRO | PP: LAT | PP: LONG

CORIOLIS FACTOR (CF) TABLE

Figure 1

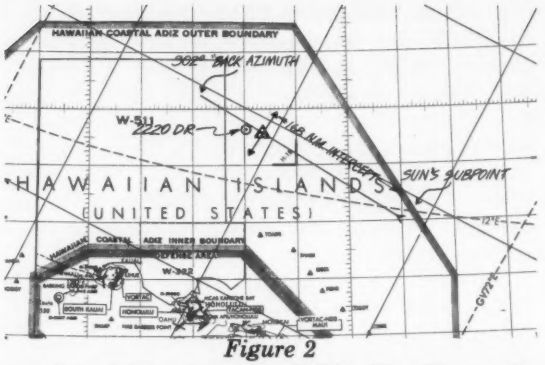


Figure 2

equal to 360° minus the GHA). The Hc on the precomp will always be 90°-00' and any intercept is plotted away.

Zero is dialed into the azimuth counters and at fix time an IRB is read as well as the true heading noted. The ZN is obtained from the formula ZN=TH-IRB. The ZN-180° is the "back azimuth LOP" from the Sun's subpoint to the aircraft location. This LOP is similar to a VOR radial. The technique is the same as that used for obtaining an LOP in radio navigation (VOR & ADF).

The navigator applies coriolis affect to the subpoint and plots the back azimuth from this point, using the most practical meridian closest to the in-flight DR. (see Figure 2).

The intercept is measured from the plotting point along the back azimuth and either a very short perpendicular line or compass arc is drawn from the plotting point. Other than the meridian used for plotting the back azimuth, the actual construction on the chart differs very little from a VOR-DME or TACAN fix.

I would caution against spinning off-time motions on this fix, as the ZN is rapidly changing. This completes the fix, which was obtained by one two-minute Sun observation. Someday this handy technique may be useful to you, especially when you're out over the water with minimum nav aids.

A 1974 graduate of the University of Colorado, Boulder, Capt Smith first was assigned to the Defense Mapping Agency, Warren AFB. After UNT and CCTS, he served as a KC-135 navigator. Capt Smith is now assigned to the 28 AREFS, Ellsworth AFB.

An interview with Major General McCartney

Recently, the Editor interviewed Major General Keith D. McCartney, Director of Manpower and Organization, HQ USAF. General McCartney was commissioned through the ROTC program in 1955, and earned his navigator wings in January 1957. His first flying assignment was in EC-121s at McClellan AFB, California, and he has held a number of important staff and personnel jobs in his career. General McCartney was Commander, US Air Force Recruiting Service immediately prior to his present assignment.

THE NAVIGATOR: Many of our readers have been concerned with the number of navigator commanders—they feel that the numbers are lower than they should be. Why do you think this has happened, and what do you foresee in the future?

GENERAL McCARTNEY: Well, I think commanders will be picked based on who is best qualified to be the commander, and that's the way it should be—not because somebody wears navigator or pilot wings. The commander clearly should be the best officer in that organization. With the career patterns that some navigators have, we don't have the navigators with the background and operational career field to assume some of those command jobs right off. As navigators are placed in command positions and work up, then they'll have the proper background. You can't make it happen overnight. In my career pattern, I didn't have the operational jobs that would have qualified me to be an operational wing commander.

Many navigators see themselves in operational-type jobs for many years, due to manning considerations and the force structure. Do you feel it's possible to have a successful career staying in ops, without any career-broadening or rated supplement tours?

There are many good jobs in operations for navigators. And there again, you must do whatever job you're given to the best of your ability and try to do your job better than any of your counterparts. That's going to make you stand apart, your boss is going to recognize that and commanders will be selecting you for bigger and better jobs. Based on your job today, you must demonstrate that you can do it better than anyone else and that applies whether you are a pilot, navigator or nonrated. I believe that dedication to excellence must be your goal. Give that extra effort—make some sacrifices.

At the Navigator Symposium you stated that dedication and sacrifice are required frequently, and oftentimes a reward for hard work will be more hard work. I think that really caught our attention.

That's right. I believe that's how you get ahead. I came to the Pentagon as a brand new colonel, and it gave me the opportunity to make my mark. One of the things you've really got to do is work hard. You must take the issues, work them extremely hard, and work in the best interests of the Air Force. If you're worried about what it's going to do for you, then you're not going to do your job to the best of your ability. If you do that job and ask yourself, "How can I do this job and get myself promoted?" you're not going to do that job right because you're doing it in a self-serving nature. You've got to do it for the Air Force and for our country. If you do your job to the best of your ability and out-compete your peers, you will be recognized. But if you are always worried about how you personally get ahead, that's going to be your objective and you're not going to be recognized for quality performance.

You started your career in EC-121s at McClellan AFB. Can you single out an event or events that have enabled you to rise to two-star rank?

One of the things I did, and I would encourage any young officer to do this, was to volunteer for every additional duty that came up. I know that among many young rated officers, additional duty is a no-no. But when I got a chance for a staff job, I was prepared because I knew how to do staff work. Those additional duties prepared me. I took advantage of the opportunities that the operational squadron made available to me and I was recognized by my squadron commander and by the wing commander for doing more than was required. So then when a bigger job came up, I'd get it. I was rewarded with more work, but career-wise it paid off because I became a better officer. With that I still did my navigation duties, and on flight exam rides I did as well as anybody in the squadron. So when the wing commander or squadron commander wanted to pick somebody for another type job, would they choose someone who does what they have to do or someone doing more for the organization than is required? I don't care what occupation you're in, when you work with people they don't want somebody that just does the bare minimum.

From time to time over the past decade or so, a "dual track" system has been proposed. In such a system, normal career progression would be possible with staff jobs and additional duties, or one would just "fly the line," with few other duties, and also with promotion limited to, say, major. What is your opinion of such a system?

Basically, I do not agree with that concept because the American people are not the type to say "I want to do that and nothing else." Initially, they may say all they ever want to do is fly an airplane, but after they've been flying long enough they'd like to be the Ops Officer, they'd like to be the Squadron Commander or the Wing Commander. Once they'd made a decision, they couldn't change it. I think it's better to have people who are more rounded. It also gives the Air Force more selectivity from which to pick the future leaders. If we had a "dual track" we'd be cutting off a large portion of that resource from which we are going to pick the future leaders and commanders of the Air Force.

In your present job, as Director of Manpower and Organization, you control the "numbers" part of the Air Force. Is that correct?

We determine the number of people it takes to do a specific function, what types, what the mix should be, and how we allocate the spaces which the Air Force is given by Congress to do our mission. We're also responsible for productivity improvements in the Air Force. So it's a very important job.

How has your navigator training helped you in this job and your previous Air Force jobs?

Well, when you go through nav training you do a lot of math, you do many computations, and you must be very accurate. You must have accurate log procedures, and you must pay attention to detail. I think any job requiring attention to detail helps you in a job like this. Just learning the navigator log procedure makes you very aware of detail and how to go about doing things in an orderly manner.

In your job, you work with AF requirements and needs. What do you see over, say, the next 5 years for the requirements and need for navigators?

The requirements are about on the same level as previously. People worry about nav requirements going away but that really hasn't happened. We have pretty straight lines. We have ups and downs in nav training, based on what happens to the retention of our force and on people separating after an initial commitment or retiring. With the aviation career incentive program, navigator retention is pretty good.

Do you think that the steps taken over the past several years to improve navigator retention have worked?

Our retention in the navigator force decreased as did retention in the NCO ranks and nonrated. But I think that was because of the overall economy, failure of the military pay raises to keep pace with inflation, and the pay caps we have had. I think the pay raises we received are the type things that make people stay in because they feel that the Congress and the President support them, and the DOD leadership supports them. It's something that the Air Force leadership is fighting for. People, by and large, love the Air Force and they really don't want to get out. With the pay raise that's come about, I think they'll stay and I think we'll see continued improvements in retention.

In your career you've undoubtedly seen many commanders, both good and bad, and you've commanded several large organizations yourself. What are some of the key things that all good commanders have in common?

One is that they take care of their people. And there are several ways of taking care of people. They let their people know where they stand, and I don't mean being a good guy. Some of the best commanders I've had are some of the toughest guys, but you always knew where you stood with them. They gave you clear guidance, they were always ready and willing to help you when you had a problem, and it was easier to take that problem to them and let them help you. Those commanders stood out. People who can be good commanders are ones who inspire their people, motivate their people, and also be very firm and set high standards of what they expect. You know what they expect so you know where you're going. They give very firm, positive guidance. They don't micromanage, they macromanage so you have freedom to do your job, but they hold you accountable. I think that's good. When I was running the Recruiting Service, General Davis (then Commander of Air Training Command) gave me almost unlimited authority to run Recruiting Service as I saw fit. He held me totally accountable, but I kept him fully informed of what I was doing. When I had a problem and needed his help, he was there willing to help me. It was a very good relationship. We communicated very effectively, and that's another key part of a commander—to be able to communicate to subordinates. I never surprised General Davis by telling him I forgot to bring something to his attention. I kept him informed. On the other hand, I knew what he wanted and expected of the Air Force Recruiting Service and hopefully I'd met all the criteria which he'd set down. He was an outstanding commander in my view based on the way he gave me the authority, responsibility, and held me accountable. He let me run my organization. I could always count on him whenever I needed any assistance.

That must have been quite a job—running the Recruiting Service.

I don't know where I could ever have a better job overall. I may have some bigger jobs, but I'll never have one which is so personally rewarding and also where you see every day what you're doing to help make the United States Air Force better. It was a very exciting thing to work with people and to see the quality of the young people we bring into the service and how they change and transform into outstanding airmen or officers. The Air Force is a sophisticated, technologically oriented service so we must have quality people to maintain our systems. We try to bring in the quality of people required to do the Air Force mission. We do have higher standards but it's needed. I don't ever see that lessening.

What was the toughest job in your career?

When I went to Recruiting Service I thought that was going to be my toughest job because at that time we were having shortfalls. We got that turned around and it turned out to be my most rewarding. We have the highest caliber of people in the Air Force, for when you've got a problem they all put their shoulders to the wheel and work together as a team. You know any job can be accomplished. Taking a positive attitude enables you to get on top of any job very soon. I've enjoyed every job I've had.

Many of our readers are 1st and 2d lieutenants just starting out. What advice can you give to these young officers beginning their careers?

It's really up to them. I learned this from a CMSgt and I think that's one of the things I'd tell new officers. Learn from all the people with whom you're working no matter what grade they are or whether they're military or civilian. Learn from each experience and put those things together to enhance your career. You're going to stand out. A

CMSgt told me one day, "Sir, how successful you're going to be in your career can be summed up in ten two-letter words." Those ten two-letter words are "If it is to be, it is up to me." To encourage any young officer I'd tell him or her—"How far you go in your career is up to you." And one of the things I mentioned at the Nav Symposium is that you're an officer first, and then you either become one of the functional area in the Air Force nonrated, or you become a pilot or navigator. But you're an officer first. How well you do your officer duties and how well you do your assigned duties will determine how far you go and how much success you have. How much dedication to excellence you have, and how much extra effort you are willing to put forth to get ahead in the Air Force will also contribute. The one who wants to just do the bare minimum is not going to be very successful in any career or profession. So, you know I think the Air Force can be a very, very successful career for the people who want to put forth a lot of effort, are dedicated to excellence, are professional, and give 100% plus effort to be the best officer they can.

I think many navigators were surprised to learn that the Air Force has so many nav generals. The photo feature in THE NAVIGATOR (Summer 1980) was very popular, for it graphically showed these successful officers.

One of the things I tell people—which I would like to include to get ahead—set your standards very high and then exceed those standards. Set your marks well above what is required. Then try to exceed those marks. Set high standards for your people because you're going to have people working for you and they need to know what you expect. You must also communicate effectively, communicate with your supervisors, communicate with your subordinates—communication with associates is the key to success.

There is a fine line between setting high standards for your people and being perceived as a "slave driver."

Well, that's why I said to communicate. You've got to communicate to them why you want them to do something. And then you've got to give them feedback, that's part of the communication process. Many times when somebody fails it's because they didn't communicate. Another part of the communication process is recognizing your people. Reward them, tell them when they do a good job. You've also got to tell them when they don't do a good job. But you must be effective in communicating. People like to be recognized and it doesn't cost money. Being a good, decent person in your day-to-day relationships with your people doesn't mean you have to be bosom buddies. You have to let them know that too, and they respect you for it. That's the way you go about it. But you've got to communicate what you want them to do and they'll do it.

What do you foresee in the future as far as your next job?

I don't really worry about what I see for myself in my next job. I always have believed that the job I have today is the most important job in my career. So, if I don't do it extremely well, it may be the last job in my career. If I look forward to what I am going to do next, then I'm not really doing the job the Air Force is giving me to do today. My objective is to do the Director of Manpower job as well or better than anybody before me. Do it with integrity and dedication and I'll be recognized for the work that I do here. The Air Force has always been very good to me as you can see, so I'm very confident that the Air Force will continue to recognize me for different assignments and challenges. But first, I have to do this job extremely well. I can't do that if I'm concentrating on where I'm going next, because I've just been here a few months. We have other people who worry about what will happen to Keith McCartney. I shouldn't have to worry about it. That's always been my philosophy through my career. That's how you get recognized—by doing your present job or your profession and doing it very well.

Thank you very much sir, for a fascinating interview and the best of luck to you.

THE INERTIAL

Major Alton G. ARNSDORFF
55 SRW/DOOL
Offutt AFB, NE

In every tanker or receiver crew member's life there comes a time, usually under the worst possible conditions, when the rendezvous beacon and/or radar doesn't function properly and all hope for a professionally executed, precise point parallel rendezvous is abandoned. Usually a differential DME/radial rendezvous follows using a common TACAN, coupled with UHF/DF information.

With a great deal of practice and even more luck, navigators become proficient at alternate rendezvous methods. But what about the less experienced navigators? What about adverse weather and high drift conditions? Also remember that the KC-10 won't have a navigator. Who will conduct the rendezvous should the receiver's equipment malfunction?

An answer to these questions is on the horizon and rapidly becoming available to almost all receivers and tankers in the air refueling business; the inertial navigation system (INS). I have used the INS rendezvous method many times over the past several years, with an excellent success rate. While I cannot take credit for its invention, I would like to offer it as an alternate rendezvous method.

Obviously, both the tanker and receiver must be INS equipped for this rendezvous. A single INS installation is acceptable, including palletized inertial (PINS). Automatic TACAN will increase the accuracy to that of radar, but is not required provided that the INS accuracy is verified prior to initiating the rendezvous.

The INS rendezvous is identical to the classic point parallel rendezvous. Procedures are the same except the INS is used instead of the rendezvous beacon and search radar. Some additional advance coordination between the receiver and tanker is required.

Upon initial contact, the receiver informs the tanker that he wishes to execute an inertial rendezvous and requests that the tanker set in the coordinates of the ARIP as well as the ARCP. This will establish a course line between the ARCP and the ARIP. The inbound receiver will already have these points set in his INS as turn points. Therefore, both aircraft can navigate to the same point. (See Figure 1.)

Figure 1

Once air refueling information is exchanged and turn range and offset are calculated, the rendezvous proceeds normally with the receiver departing the ARIP and the tanker turning to a reciprocal heading. At this time, the receiver will instruct the tanker to insure that the ARIP to ARCP leg is set up in the INS. In this configuration the tanker's INS will display an increasing distance from the ARCP as he tracks toward the receiver. The tanker is also instructed to displace himself right of course a distance equal to the computed offset, and to parallel the course with this offset.

The receiver, meanwhile, continues toward the ARCP on centerline from the ARIP. Once the rendezvous starts, INS distance to the ARCP is periodically exchanged. The difference between the two is the range of the tanker from the receiver. Offset is taken care of by the tanker INS and is periodically crosschecked by the tanker navigator. (See Figure 2.)

INS distance is exchanged until the 60 nm range call, at which time a UHF/DF check coupled with a TACAN DME/radial check, if available, will indicate the success of the rendezvous. As turn range is approached, more frequent distance exchanges are made. When the distance difference equals the turn range, the tanker is instructed to start his turn. With large offsets an additional mile should be subtracted from the turn range as the distances are along track and not slant range. With proper procedures the tanker will roll out on the INS course centerline in the normal position in front of the receiver. If visual contact is not established, INS distance, off course distance and UHF/DF steers will complete the hookup. (see Figure 3).

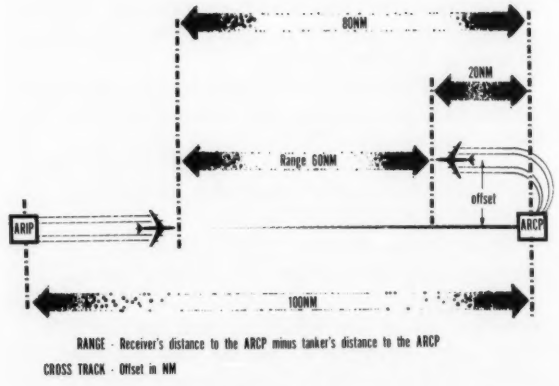


Figure 2

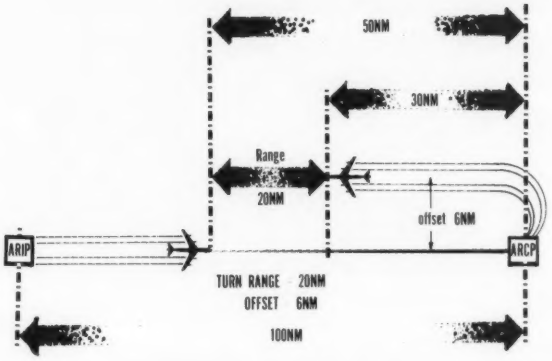


Figure 3

Experience with and confidence in this method can be realized by practicing it while monitoring the rendezvous beacon on the search radar. Alternately, the tanker can establish cross track with his INS and eliminate the offset problem for the receiver navigator while a normal radar directed rendezvous is accomplished.

The INS rendezvous is a very simple maneuver to perform. Its accuracy is limited only by the accuracy of the two INS systems. I offer it as a simple and accurate method of alternate rendezvous.

Maj Arnsdorff graduated from Newberry College and has a master's degree from the University of North Carolina. He has served chiefly in the C/KC/EC-135 and E-4 aircraft. He also had a tour as an AFROTC instructor at North Carolina State University, Raleigh. Maj Arnsdorff now is assigned to the 55 SRW, Offutt AFB.

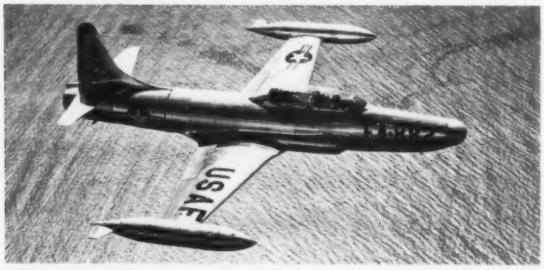
the F-94

FIRST KILL IN KOREA

The Lockheed F-94 was one of the first two-seat jet fighters flown by the Air Force. Using the T-33 as a basis, the first F-94A flew in 1949, and the Air Force took delivery in June 1950. The radar observer was an invaluable part of the crew, for he "called the shots" during an intercept.

Over 800 F-94s were delivered to the Air Force in A, B, and C model variants. Although phased out of service by 1960, the Starfire played a very important role in the air defense of the US and in Korea. Few people know this, but F-94Bs downed four enemy aircraft during that conflict. The following narration is by Capt Ben Fithian, the first F-94 pilot to down an aircraft in air-to-air combat. This occurred on 31 January 1953, and marked not only the first kill by the F-94, but also the first kill by an Air Force two-seat jet. (Reprinted with permission from AIR ENTHUSIAST QUARTERLY)

It was a clear, cold night in January, 1953. My radar observer (nav) Sam Lyons and I were on alert at K-13 (Suwon) and about third to go in the scramble order. We heard through Intelligence that there was quite a bit of enemy air activity over North Korea. About that time, a call came in from the K-13 tower asking to scramble an airplane to pace an F-80 from the 8th Fighter Bomber Wing in for a landing. The F-80 had lost its airspeed indicator. Operations selected Sam and me to do the job. We scrambled and took about 15 minutes locating, joining up and pacing the F-80 in for a landing. We were too heavy on fuel to land so we changed to a tactical channel and requested to be vectored into North Korea.



Since one of the aircraft on station near Chado Island was having trouble with its radar, we were accepted to fill in this slot.

On the way in, I heard the F-94 ahead of us calling "no joy" which meant they could not establish radar contact. In fact, the pilot was afraid that the Chado radar was vectoring them in on rocks projecting from the sea.

When we got within about 50 miles of the activity, Chado released the other F-94 for recovery at K-13 and took control of us. We were at about 25,000 ft. They started giving us range and direction to a "hostile." It was something like 30 miles away at one o'clock. They gave us a descent order to 5,000 ft and a series of turns. We ended up at 5,000 ft going southeast about 10 miles west of Pyongyang, the capital of North Korea. We were six miles behind the hostile who was doing about 130 kts. We swung behind the target and continued to descend. We made the first radar contact at about 5 miles.

To get the optimum advantage with our airborne radar fire control system, we descended to tree-top level. It was a moonlit night and I could see the ground under us, but not ahead. Once I looked out and we were very close over some trees that looked like tall sycamores, so I climbed up a bit. I figured that the Korean pilot probably knew the terrain and if he could get through, we could too. Also, the prize of the first "kill" using the F-94 was worth laying it all on the line. We made radar contact again at slightly less than five miles and I slowed down a bit to about 130 kts. With speed brakes extended, after getting a lock on the target, we started to climb and close. The enemy aircraft was at about 1,500 ft altitude. We had an overtake speed of about 40 kts when we got into range of 1,200 ft.

Our centerfold painting depicts the first kill by an F-94, from the 319 FIS, over North Korea.

FRED HULL

FA-449

I started firing on the radar scope. I fired a long burst and saw no results. We continued to close and I fired again. Still no hits! We were at about 600 ft behind the target and I moved the stick around in about a six-inch circle and saw some flashes. We were armed with armour piercing incendiaries. They made a flash upon impact. As soon as I saw a lot of flashes, I held the stick steady and continued to fire. The hostile burst into flames and started down. He crashed with the cockpit closed.

We called "splash one" and Chado gave us a vector towards another hostile about eight miles away. We were low on fuel due to our escorting the F-80 at the beginning. Our altitude was still very low and we ran into some intense ground fire. As we climbed out of it, Sam said he had a fire in the rear cockpit. I thought we had been hit by the ground fire, but it turned out to be an electrical short which went away when the rear cockpit light was turned off.

On recovery at K-13, we did a victory roll and landed. We were met in the revetment area by almost everyone in our squadron. When we shut our engine off everyone clapped.

After that night, it was several months before the North Koreans flew at night, or at least were detected by our radar off Chado Island.

EF-111A

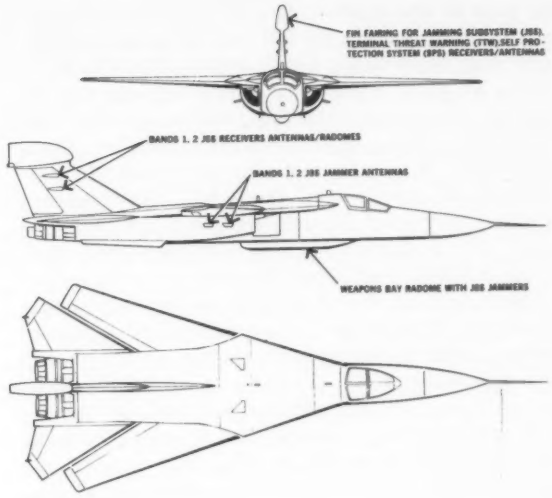
Captain David H. SCIRE
TAWC/Det 3
Mt Home AFB, ID

The EF-111A is about to make its tactical debut. What an airplane! Capable of automatically jamming hundreds of signals simultaneously, it can fly at Mach 2 + and, at lower airspeeds, stay airborne over four hours without refueling. With its sophisticated jamming equipment it can blind enemy early warning and acquisition radars. Where are these aircraft being modified? Where are aircrews trained? What kind of missions will they fly? Read on, aviators, read on!

The EF-111A is a modified swing-winged F-111A fighter/bomber which was chosen because of its speed, loiter time and existing supply line. Grumman Aerospace Corporation takes an F-111A to its Calverton, Long Island plant and completely disassembles it. The wings and the vertical stabilizer are removed, as is most wiring, both seats and all cockpit instrumentation. When I visited the plant three of the aircraft were in various stages of

assembly/disassembly. Parts were so scattered that the birds were barely recognizable. After the plane is taken apart, the real changes begin.

The most noticeable change is to the vertical stabilizer which now has a great bulge at its top to house most of the receiving antennas. The weapons bay has traded bombs for transmitters and associated antennas. The 60 KVA generators of the F-111A have been uprated to 90 KVA units to handle the considerable wattage requirements of the jamming gear. Cockpit changes include moving all engine instruments to the left side, removing the bombing system, relocating the radar tracking handle to the middle console and moving the navigation computer to the center of the main panel (so the pilot can perform navigator duties if need be). The most conspicuous change from an EWO's view is the removal of the right side stick and throttles (the stick gave way to the jammer computer control box). Unless the EWO has a long left arm, it's going to be tough to log any stick time!


FIN FAIRING FOR JAMMING SUBSYSTEM (JSS), TERMINAL THREAT WARNING (TTW), SELF PROTECTION SYSTEM (SPS) RECEIVERS/ANTENNAS
BANDS 1, 2 JSS RECEIVERS ANTENNAS/RADOMES
BANDS 1, 2 JSS JAMMER ANTENNAS
WEAPONS BAY RADOME WITH JSS JAMMERS

When the parts settle, the EF-111A fleet will total 42—28 at Mountain Home AFB, Idaho, and 14 in Europe. Delivery began in October 1981 and will extend through 1984. Mountain Home will be the training base and will also have an operational squadron (the 338 ECS was activated there on 1 July 81) and Europe will have one operational squadron. Both bases will be PCS assignments but that is not to say there will be little TDY involved; just the opposite is true. There will be many exercises, many static displays and, hopefully, some "good deal" off station training (OST) sorties.

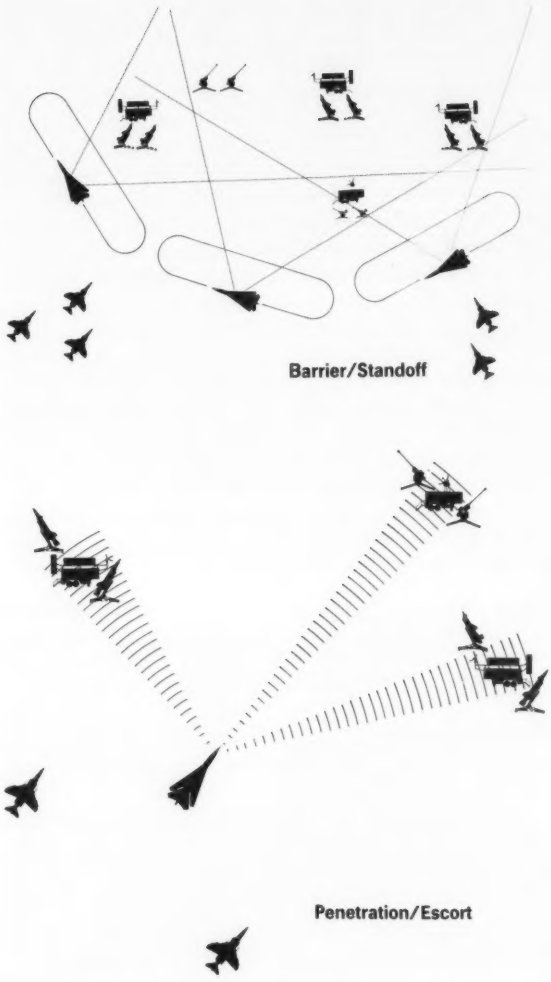
Besides OSTs, aircrews will gain proficiency in several ways. The first 11 crews have already been scheduled to train at Grumman, with two crews in Nov 81, four crews in Jan 82, and the rest in March 82. They will receive six weeks of academics and simulator training to learn ALQ-99 operation. The Grumman simulator consists only of the ALQ-99 scope and computer control, and is presently the only available simulator. The Air Force will acquire a simulator in 1986 with full cockpit instrumentation and crew accommodations. For flying training, we now run the prototype aircraft (041) against NORAD sites which are few and far between (sparse signal density). The Air Force is trying to solve the lack of signals by implementing an EW/GCI type range which will give the desired signal diversity and density. The range location, equipment and operational date are still pending. In 1983, the 388 ECS will start training 12 crews

per year in two classes. The EF will always have experienced pilots in the left seat but around 1983, they may start using EWOs right out of Mather. While in EWO school, students will get some hands-on training in the ALQ-99 because the T-5 simulator is being modified to accommodate that equipment. Students will also be exposed to the other ECM gear aboard the EF such as the ALR-62 Terminal Threat Warning System, the ALQ-137 Terminal Threat Jammer and the ALE-28 Chaff and Flare System.

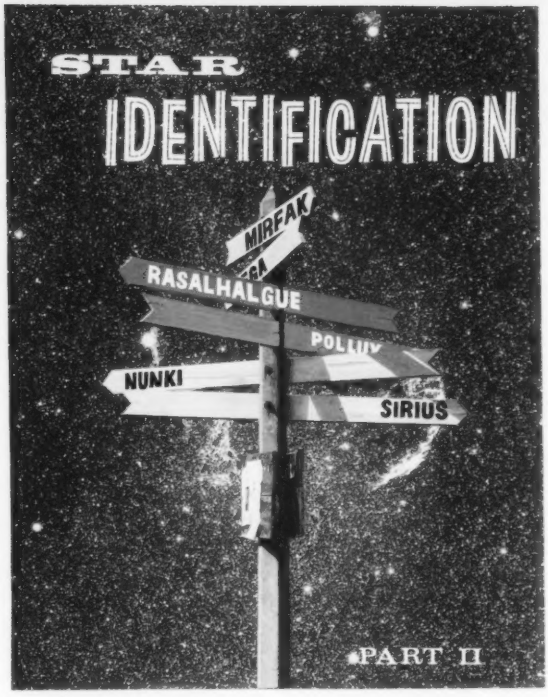
The heart of the EF-111A is the ALQ-99E Jamming Subsystem. It consists of 10 jammer stations with associated directional antennas (in the weapons bay), 5 exciters to drive the transmitters, and 6 multichannel digitally tuned receivers covering 7 bands. The system also has an encoder which analyzes all signals detected by the receivers, a converter synchronizer unit which converts analog data to digital and vice versa, and the 4 Pi computer whose primary functions are systems initialization, receiver control, jammer management, and built-in-test. Information is displayed on a 9 x 7 inch cathode ray tube called the digital display indicator, and information is input to the system via the DDI control found between the EWOs knees. The ALQ-99, by blinding enemy radars, can significantly cut aircraft losses and has proven through numerous tests that it meets design objectives.

The EF will perform its tasks via three mission profiles. First, and predominately, is stand-off jamming—setting up an orbit outside the range of most threats and pointing the jamming antennas towards the enemy. Next is close-in jamming—moving closer to the threats but still out of the range of most. Finally, is the penetration/escort role—the EF ingresses with the attacking forces. In all three roles, the EF (ALQ-99) is concerned mainly with jamming the early warning and acquisition radars—not terminal threat radars. The EF does carry the ALQ-137 for terminal threat jamming but that is for self-protection. Of all the missions, the most demanding and dangerous is undoubtedly the penetration/escort. Leading a four-ship strike force at altitudes less than 500 feet at speeds greater than 500 knots, then popping up in the vicinity of the target to cover ingress and egress can only be described as harrowing. The target would have to have a very high priority to warrant such an exposure of costly resources.

Well, there you have it! When the EF-111A hits Initial Operational Capability, an experienced cadre will be ready to support worldwide missions with the most sophisticated jamming available, increasing the probability of target destruction and, best of all, aircraft survivability.



A graduate of the University of Tennessee in 1971, Capt Scire was commissioned through OTS. He then completed UNT and EW training. For the next four years, he was assigned to the B-52 at Ellsworth AFB, followed by the F-111A. Capt Scire now is assigned to the EF-111 at Mt Home AFB.



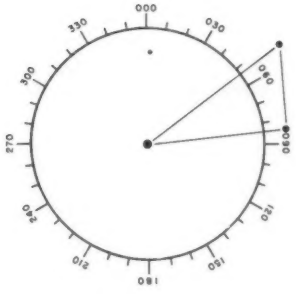
Part 2 of Star Identification includes 14 stars used in HO 249, Volume 1. The remaining 11 stars will appear in the Spring issue of THE NAVIGATOR.

Each chart shows the first, second, third, and fourth magnitude stars that are visible when the desired star is "centered" in a sextant with a 15° field of view. Lines are included to make the patterns more meaningful. The stars are shown as they would appear from the North Pole. For other latitudes, the accompanying tables of position angles tell how much the charts should be rotated to give the positioning relationship for the time of the observation. Dashes are used to indicate that the star is below the horizon.

To use the charts, enter the tables with the closest values of latitude and LHA of Aries to find the position angle. (Though interpolation can be used, it is not usually necessary to do so.) Then rotate the chart until the position angle is at the top; the star pattern that results is the one that will appear in the sextant.

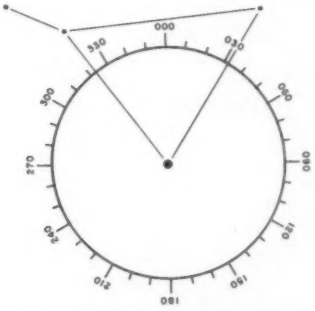
Say, for example, that you want to shoot Menkar and your latitude is 33N and the LHA of Aries is 114. Using 30N and 120 will give you a position angle of 300. Rotate the Menkar chart so that 300 is at the top. With Menkar centered in the field of vision, you will find the identifying "parallelogram" pattern extending to the right.

DENEBOLA



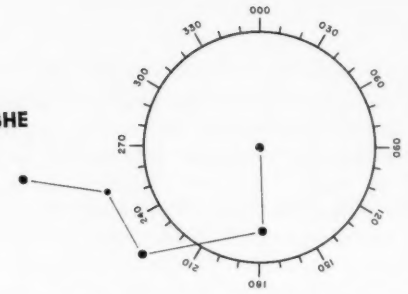
LHA Υ / Lat	0	30	60	90	120	150	180	210	240	270	300	330
80N	000	005	009	010	009	005	359	354	351	350	352	355
70N	-	-	018	021	018	010	359	347	340	340	344	-
60N	-	-	027	031	028	016	357	339	330	330	-	-
50N	-	-	-	042	039	025	356	330	319	320	-	-
40N	-	-	-	052	051	036	353	318	308	310	-	-
30N	-	-	-	062	063	052	348	303	297	300	-	-
20N	-	-	-	072	075	073	328	285	285	290	-	-
10N	-	-	-	081	088	096	224	267	274	-	-	-
0	-	-	-	091	099	116	196	250	263	-	-	-
10S	-	-	-	101	110	132	190	237	253	-	-	-
20S	-	-	-	-	121	143	187	225	243	-	-	-
30S	-	-	-	-	130	151	185	216	234	-	-	-
40S	-	-	-	-	139	157	183	209	224	-	-	-
50S	-	-	-	-	147	162	183	203	215	-	-	-
60S	-	-	-	-	156	167	182	196	207	-	-	-
70S	-	-	-	-	-	171	182	191	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

DIPHDA



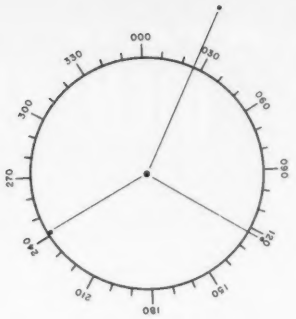
LHA Υ / Lat	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	003	353	-	-	-	-	-	-	-	-	-	-
60N	005	350	337	-	-	-	-	-	-	-	-	018
50N	007	346	330	-	-	-	-	-	-	-	-	025
40N	009	342	323	-	-	-	-	-	-	-	046	031
30N	011	338	314	301	-	-	-	-	-	-	055	040
20N	015	332	305	292	-	-	-	-	-	-	064	048
10N	020	323	295	283	-	-	-	-	-	-	074	057
0	030	310	285	273	-	-	-	-	-	-	083	069
10S	052	290	273	263	-	-	-	-	-	-	094	084
20S	104	261	259	254	-	-	-	-	-	-	105	100
30S	145	233	245	243	-	-	-	-	-	121	115	115
40S	160	214	232	232	-	-	-	-	-	130	126	131
50S	168	202	220	222	217	-	-	-	-	141	137	144
60S	173	194	208	212	208	-	-	-	-	150	148	156
70S	176	188	197	201	199	192	-	-	165	160	159	165
80S	178	184	189	191	189	186	182	177	172	169	170	173

DUBHE



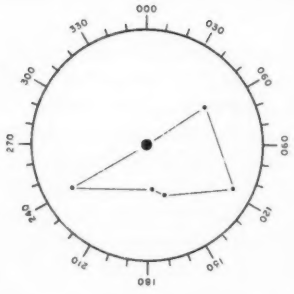
LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	004	012	018	021	019	008	353	341	339	342	348	356
70N	007	020	032	042	047	032	330	313	318	328	339	352
60N	008	026	043	059	075	097	260	284	300	316	333	351
50N	009	030	050	070	095	136	219	264	288	309	328	348
40N	011	034	057	079	107	149	208	251	279	302	325	348
30N	012	037	062	087	115	154	202	243	271	297	320	346
20N	-	-	067	092	121	158	199	236	266	292	318	-
10N	-	-	071	098	126	160	198	232	260	287	-	-
0	-	-	-	103	131	162	196	228	255	-	-	-
10S	-	-	-	-	134	164	195	224	-	-	-	-
20S	-	-	-	-	138	165	193	221	-	-	-	-
30S	-	-	-	-	-	-	-	-	-	-	-	-
40S	-	-	-	-	-	-	-	-	-	-	-	-
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

ENIF



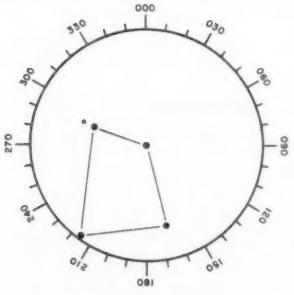
LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	354	350	350	351	356	000	006	009	010	008	005	000
70N	348	341	340	-	-	-	-	018	020	017	009	358
60N	340	332	330	-	-	-	-	-	030	027	016	357
50N	331	320	320	-	-	-	-	-	041	037	023	356
40N	321	310	310	-	-	-	-	-	051	049	033	354
30N	307	298	300	-	-	-	-	-	061	061	046	350
20N	291	287	291	-	-	-	-	-	070	072	066	340
10N	273	276	-	-	-	-	-	-	081	085	088	270
0	256	265	-	-	-	-	-	-	090	096	110	202
10S	240	254	-	-	-	-	-	-	101	108	127	191
20S	228	244	-	-	-	-	-	-	111	119	139	188
30S	218	234	-	-	-	-	-	-	-	129	148	186
40S	210	225	-	-	-	-	-	-	-	138	156	184
50S	203	216	-	-	-	-	-	-	-	147	162	183
60S	197	207	-	-	-	-	-	-	-	155	167	182
70S	191	-	-	-	-	-	-	-	-	163	172	182
80S	-	-	-	-	-	-	-	-	-	-	-	180

FOMALHAUT



LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	-	-	-	-	-	-	-	-	-	-	-	-
60N	-	-	-	-	-	-	-	-	-	-	-	-
50N	350	332	-	-	-	-	-	-	-	-	027	009
40N	347	327	-	-	-	-	-	-	-	-	033	011
30N	344	320	-	-	-	-	-	-	-	-	039	014
20N	341	313	295	-	-	-	-	-	-	065	046	017
10N	337	305	286	-	-	-	-	-	-	073	053	020
0	330	296	278	-	-	-	-	-	-	081	062	027
10S	320	286	268	-	-	-	-	-	-	091	073	036
20S	301	273	259	-	-	-	-	-	-	101	087	055
30S	266	258	249	236	-	-	-	-	123	111	101	094
40S	228	242	238	228	-	-	-	-	131	121	118	135
50S	207	227	227	219	-	-	-	152	140	133	134	157
60S	195	212	215	211	201	187	172	159	149	145	148	166
70S	188	200	204	201	194	185	174	165	159	157	161	173
80S	184	189	192	191	187	183	177	172	169	168	171	177

GIENAH

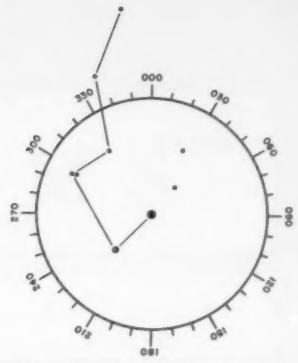


LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	-	-	-	-	-	-	002	351	-	-	-	-
60N	-	-	-	-	-	016	002	347	336	-	-	-
50N	-	-	-	-	035	022	002	342	328	-	-	-
40N	-	-	-	-	044	028	004	338	320	-	-	-
30N	-	-	-	-	053	035	005	333	311	-	-	-
20N	-	-	-	-	061	043	006	325	302	-	-	-
10N	-	-	-	-	072	053	008	315	293	281	-	-
0	-	-	-	-	082	066	012	302	282	272	-	-
10S	-	-	-	101	092	081	026	284	271	261	-	-
20S	-	-	-	110	104	099	119	261	258	252	-	-
30S	-	-	-	120	114	118	164	239	246	242	-	-
40S	-	-	-	129	126	135	172	220	233	232	-	-
50S	-	-	-	139	138	147	175	207	221	222	-	-
60S	-	-	156	149	149	158	177	198	209	212	207	-
70S	-	171	163	160	160	166	179	191	199	201	198	191
80S	180	175	172	169	170	174	179	185	189	191	189	186

HAMAL

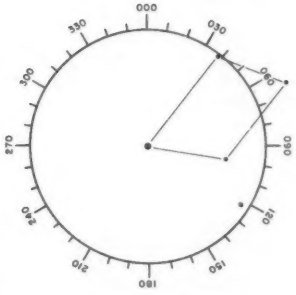
LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	007	000	355	350	349	351	354	000	005	009	011	010
70N	014	001	347	340	338	342	349	000	009	017	022	020
60N	024	001	340	330	329	335	-	-	-	023	030	031
50N	036	003	327	316	317	326	-	-	-	033	042	045
40N	051	005	311	303	307	-	-	-	-	-	052	057
30N	071	017	289	290	297	-	-	-	-	-	062	069
20N	091	155	266	278	288	-	-	-	-	-	071	081
10N	109	172	247	266	278	-	-	-	-	-	080	092
0	124	175	233	256	270	-	-	-	-	-	-	102
10S	134	177	222	246	-	-	-	-	-	-	-	112
20S	142	177	215	237	-	-	-	-	-	-	-	121
30S	149	178	208	229	-	-	-	-	-	-	-	129
40S	155	178	203	221	-	-	-	-	-	-	-	138
50S	160	178	198	213	-	-	-	-	-	-	-	-
60S	166	179	192	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

KOCHAB



LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	344	355	007	019	029	037	038	018	335	321	324	333
70N	336	353	010	028	045	064	086	131	244	279	300	318
60N	331	352	013	034	055	079	109	155	215	257	286	309
50N	327	350	014	037	062	088	120	162	208	247	277	303
40N	324	350	015	040	066	093	125	164	204	241	271	299
30N	323	349	017	043	070	098	130	165	203	237	268	295
20N	321	349	017	045	073	101	133	166	200	234	265	292
10N	-	-	-	-	076	104	135	167	200	231	262	290
0	-	-	-	-	-	107	137	167	199	230	258	-
10S	-	-	-	-	-	-	139	168	197	227	-	-
20S	-	-	-	-	-	-	-	-	-	-	-	-
30S	-	-	-	-	-	-	-	-	-	-	-	-
40S	-	-	-	-	-	-	-	-	-	-	-	-
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

MENKAR



LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	007	003	358	353	351	350	-	-	-	-	010	009
70N	015	006	355	345	340	-	-	-	-	-	-	020
60N	023	009	351	338	330	-	-	-	-	-	-	030
50N	032	014	347	328	320	-	-	-	-	-	-	040
40N	043	020	343	319	311	-	-	-	-	-	-	050
30N	054	029	334	307	300	-	-	-	-	-	-	060
20N	066	043	320	294	290	-	-	-	-	-	-	071
10N	080	068	294	280	279	-	-	-	-	-	-	081
0	094	104	254	266	269	-	-	-	-	-	-	091
10S	107	131	225	252	259	-	-	-	-	-	-	101
20S	119	147	209	240	248	-	-	-	-	-	-	111
30S	131	157	200	228	238	-	-	-	-	-	-	121
40S	141	163	195	218	228	-	-	-	-	-	-	132
50S	150	168	191	209	219	-	-	-	-	-	-	141
60S	158	171	188	201	208	-	-	-	-	-	-	151
70S	165	174	185	194	199	-	-	-	-	-	-	161
80S	172	178	182	186	-	-	-	-	-	-	-	-

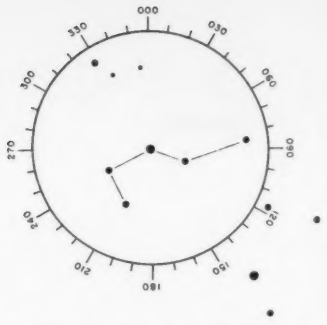
MIAPLACIDUS

LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	-	-	-	-	-	-	-	-	-	-	-	-
60N	-	-	-	-	-	-	-	-	-	-	-	-
50N	-	-	-	-	-	-	-	-	-	-	-	-
40N	-	-	-	-	-	-	-	-	-	-	-	-
30N	-	-	-	-	-	-	-	-	-	-	-	-
20N	-	-	-	-	-	-	-	-	-	-	-	-
10N	-	-	-	047	018	348	319	-	-	-	-	-
0	-	-	079	049	019	347	316	287	-	-	-	-
10S	-	111	082	052	021	347	314	284	255	-	-	-
20S	141	114	086	056	022	345	310	279	252	225	196	168
30S	143	117	090	060	024	344	307	275	248	222	196	170
40S	146	121	095	066	027	342	302	270	244	219	195	170
50S	148	126	102	073	033	338	293	263	239	216	193	171
60S	152	132	112	087	046	328	279	253	231	211	192	172
70S	158	142	127	113	098	264	250	236	221	205	190	174
80S	165	157	151	150	164	191	209	210	205	196	186	176

MIRFAK

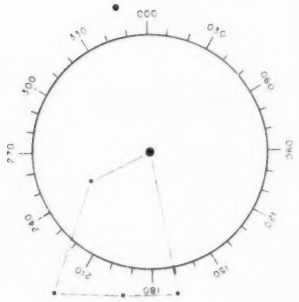
LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	013	007	357	348	344	345	350	355	002	008	014	016
70N	031	018	350	332	328	332	341	352	004	015	025	032
60N	051	041	334	310	312	321	334	350	005	021	034	045
50N	070	082	274	286	298	312	329	347	007	025	042	057
40N	087	118	219	265	286	304	324	345	008	030	050	067
30N	099	135	204	251	277	297	318	-	-	-	056	076
20N	109	145	198	241	269	290	-	-	-	-	062	085
10N	116	151	195	234	261	284	-	-	-	-	-	091
0	123	154	193	228	254	-	-	-	-	-	-	098
10S	129	158	191	222	248	-	-	-	-	-	-	-
20S	134	160	190	219	-	-	-	-	-	-	-	-
30S	-	163	189	214	-	-	-	-	-	-	-	-
40S	-	-	-	-	-	-	-	-	-	-	-	-
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

NUNKI



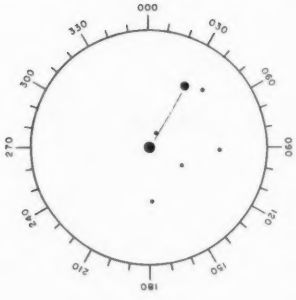
LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	-	-	-	-	-	-	-	-	-	-	-	-
60N	-	-	-	-	-	-	-	-	-	007	352	-
50N	-	-	-	-	-	-	-	-	027	009	349	332
40N	-	-	-	-	-	-	-	-	033	012	347	326
30N	-	-	-	-	-	-	-	056	040	015	343	319
20N	294	-	-	-	-	-	-	065	047	017	340	312
10N	285	-	-	-	-	-	-	074	055	022	335	302
0	276	-	-	-	-	-	-	083	065	030	327	293
10S	267	-	-	-	-	-	-	092	077	042	313	281
20S	257	-	-	-	-	-	-	102	091	068	289	269
30S	247	236	-	-	-	-	123	112	107	111	250	254
40S	236	228	-	-	-	-	131	123	123	144	220	238
50S	225	219	-	-	-	-	141	134	137	159	203	223
60S	214	210	201	-	-	159	149	146	151	168	193	210
70S	202	200	194	185	174	165	160	158	162	174	188	198
80S	191	190	187	183	177	173	170	169	172	177	184	188

PEACOCK



LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	-	-	-	-	-	-	-	-	-	-	-	-
60N	-	-	-	-	-	-	-	-	-	-	-	-
50N	-	-	-	-	-	-	-	-	-	-	-	-
40N	-	-	-	-	-	-	-	-	-	-	-	-
30N	-	-	-	-	-	-	-	-	-	-	005	339
20N	311	-	-	-	-	-	-	-	-	034	006	327
10N	300	-	-	-	-	-	-	-	065	038	006	334
0	301	278	-	-	-	-	-	-	070	041	008	332
10S	295	269	-	-	-	-	-	100	075	046	008	328
20S	290	264	239	-	-	-	-	107	082	052	010	324
30S	281	257	234	211	-	-	135	113	089	060	012	317
40S	271	249	220	207	185	161	140	119	098	071	016	305
50S	258	240	222	204	184	164	144	128	109	090	013	282
60S	240	224	215	200	184	167	151	136	125	116	144	243
70S	217	214	206	195	182	170	158	149	142	140	174	207
80S	197	198	194	189	181	174	168	163	163	167	178	190

POLLUX



LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	010	011	009	005	359	353	349	349	351	356	001	006
70N	019	023	021	012	358	345	338	338	343	351	001	012
60N	028	034	033	022	356	333	326	328	336	347	-	016
50N	035	044	046	035	353	320	313	318	327	-	-	-
40N	043	054	060	054	346	302	300	308	-	-	-	-
30N	-	065	074	079	301	282	289	298	-	-	-	-
20N	-	074	086	103	206	263	277	290	-	-	-	-
10N	-	083	097	122	193	248	267	280	-	-	-	-
0	-	092	107	134	188	235	257	-	-	-	-	-
10S	-	-	117	143	186	226	248	-	-	-	-	-
20S	-	-	125	149	185	218	240	-	-	-	-	-
30S	-	-	133	155	184	212	231	-	-	-	-	-
40S	-	-	141	160	184	207	223	-	-	-	-	-
50S	-	-	-	163	183	201	-	-	-	-	-	-
60S	-	-	-	-	182	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

NAVIGRAMS

We are proud to present the navigator leaders recently selected for promotion to colonel. Congratulations and best wishes for continued success from THE NAVIGATOR.

Adee, Donald P.
Anderson, Paul C.
Anderson, William F.
Arent, William L.
Baker, Roy T.
Bakunas, Darius V.
Barnhill, Charles C., Jr.
Bedingfield, Jerry R.
Bennett, Frank J.
Beringson, Richard J.
Betsill, Sammy F.
Bevis, James N.
Bogart, Bruce C.
Boyce, James W., Jr.
Brittain, Claire E., Jr.
Brooks, David M.
Brownfield, Orlen L.
Browning, Robert L.
Burchfield, Joseph P. III
Burke, Edward J.
Burns, Melvin W.
Byrne, Richard L.
Cantergiani, Joseph C.
Care, Francis J.
Carey, Charles C.
Carlstrom, David L.
Chace, Henry V.
Chambers, John A.
Clemons, Larry C.
Cooke, Paul M. T., Jr.
Correll, Monte R.
Coupland, James W.
Cox, Claude D.
Crawford, Thomas J.
Crosby, Francis C.
Czelusniak, Donald R.
Daniel, Marshall E., Jr.
Dempsey, Mark R.
Deruiter, David H.
Dingle, Robert J., Jr.
Druva, Karlis J.
Dupre, James J.
Eatman, Robert W.
Entsminger, Joseph E.
Fuller, Monroe J.
Gastner, Robert R.
Gatto, Francis R.
Gilbert, Charles L.
Gill, Gerald W.
Gindlesperger, Larry P.
Gingery, David W.
Gonzalez, Louis P., Jr.
Hall, Samuel L.
Hansen, William C.
Harry, William T., Jr.
Hickey, Edward C., Jr.
Hicks, Charles F.
Hicks, Gary L.
Hobbs, Fleming C., Jr.
Hogan, James J., Jr.
Hogan, William E.
Holloway, Robert J.
Hosley, David L.
Howell, Marvin W.
Israel, Kenneth R.
Jones, Charles A.
Kavanagh, Brian O.
Kelley, Russell K.
Kelly, John L., Jr.
Kennedy, Hamilton W.
Kholos, Clark J.
Kiser, John O.
Knecht, Ronald J.
Knotts, Jerry E.
Kowalski, Harold W., Jr.
Kozak, David J.
Krebs, William E.
Mackay, Roderic D.
Mackie, William A. J.
Mangina, Joseph A.
Manz, Louis R., Jr.
Maybaum, Frederick L.
Maypole, Thomas A.
McBride, Charles W.
McCall, Edward D.
McCullough, Donald J.
McCune, James D.
McLaughlin, Edward A.
Meyer, John H.
Meyer, Robert J.
Moats, Wilton B., Jr.
Moore, John L.
Moore, Paul B., Jr.
Moore, Richard A.
Morgan, Richard E.
Morris, David L.
Morrison, Malcolm B.
Morton, John T.
Murphy, Richard M.
Nash, Donald S.
Nelson, David R.
Newland, Samuel R., Jr.
O'Connor, Thomas J.
Phillips, John A.
Poates, John T.
Pond, John R.
Porterfield, John R. II
Price, Steven E.
Prine, Lavelle
Quigley, James B.
Ratcliffe, James A.
Reid, Robert E.
Rich, Donald W.
Robinson, Michael N.
Roderick, Douglas A.
Rosenbach, William E.
Ross, Bruce E.
Rup, Joseph M., Jr.
Ruskiewicz, Daniel F.
Schmidt, John E.
Scivoletto, Emmanuel J.
Scooler, Donald
Sfameni, Peter E.
Silvia, Ronald
Smart, Halbert R. II
Steel, Dean E.
Stenson, Stephen S.
Steward, Ronnie B.
Stewart, James R.
Stiles, Thomas L.
Stolp, James T.
Stotts, Jackie L.
Stover, Thomas A.
Sullivan, Robert D.
Swartz, J. A.
Terrill, Leo M.
Thomas, Raymond C., Jr.
Turcotte, Maurice E.
Ullrey, Larry L.
Waite, Richard W.
Ward, Patrick J.
Wesen, Charles L.
Wilbur, Anthony D. H.
Wilson, Harry F., Jr.
Wilson, Jack G.
Wilson, William P.
Zych, Leonard P.

The Silver Wings Museum at Mather Air Force Base is building a collection of Navigator Training patches, and over 130 have been received. Eventually the museum hopes to have a patch from every navigator training class from World War II to the present. If you have a patch from your nav class and would like to donate it to the collection, please contact Major Bert Hetrick, 323 FTW/DOTN, Silver Wings Museum, Mather AFB, CA 95655. Patches will be displayed with the class number and name of the donor. Duplicates will be promptly returned.

PLOP BY TEMPERATURE

Captain Michael J. SIEVERDING
34 TATG/TTX
Little Rock AFB, AR

Pressure lines of position (PLOPs) have been around quite a while. Shortly after the invention of a reliable radar altimeter, navigators noticed if their fix data indicated drift, the true altitude changed between fixes—the greater the drift, the greater the true altitude change. In the Northern Hemisphere, true altitude increased when drift was to the left and decreased when drift was to the right. Various weather wizards developed a procedure to quantify this observed relationship between true altitude change and drift. Thus, PLOPs were born.

PLOPs are used routinely in SAC and MAC as a standard navigational procedure. With a pressure altimeter, radar altimeter, compass, and airspeed meter, the nav will get an LOP when flying overwater. It's a neat trick and usually works well. Navs have been given generalized guidance to determine when PLOPs should work well or not work at all.

Navigators have also noticed a relationship between changes in outside air temperature and drift. In the Northern Hemisphere, the temperature usually got colder between fixes when drift was to the right and warmer when drift was to the left. The weather wizards then developed a procedure to quantify this observed relationship between temperature change and drift. Thus, PLOP by temperature was born.

PLOP by temp tables were published in SACP 55-10 and are incorporated into the current MACR 55-130. With a pressure altimeter, a temperature indicator, a compass, and an airspeed meter, the nav will get an LOP when flying overwater or overland. This also is a neat trick that usually works well. But when doesn't it? Is PLOP by temperature as accurate as PLOP by radar altimetry? What are its drawbacks—its advantages?

This article tries to answer these questions, gives a quick overview of the scientific basis for PLOP by temp, provides an updated PLOP by temp table, and suggests alternate methods for PLOP by temp solutions.

PLOP by temp is based on the geopotential air mass equation, an equation full of unintelligible constants and meteorological mystery. Through some applied algebra and a generous helping of aircrew logic (a dichotomy of terms?) the monster equation can be simplified to:

$$\frac{TA}{PA} = \frac{AK}{SK} \quad (Eq\ I)$$

where:

TA = true altitude

PA = pressure altitude

AK = actual temperature in degrees Kelvin

Note: degrees Kelvin = degrees Celsius + 273.16

SK = ICAO Standard Day temperature Kelvin for PA

Note: SK = 288.16-[1.9812(PA^t)] degrees Kelvin; where PA^t is equal to PA in thousands of feet.

Equation I assumes that the air mass between the aircraft and the surface precisely follows the standard lapse rate of 2° (more precisely 1.9812°) per 1,000 feet. This is not always true. Any "D" value gained with Equation I will be an approximation; however, the change between successive "D" readings (D2-D1) will be accurate. Equation I can be algebraically massaged to reflect the measurement of temperature change and expanded into:

$$\Delta D = \frac{PA}{SK} (\Delta AK) \quad (Eq\ II)$$

where:

ΔD = D2-D1

ΔAK = the change in temperature between positions.

Using Equation II the nav needs only to compare temperature readings between positions (ΔAK) to gain an automatically derived D2-D1 (ΔD). There is no need to compute individual "D" readings. Plugging ΔD directly into the standard PLOP formula gains a PLOP ZN.

The following table was constructed using Equation II.

This table can be interpolated and used by any aircraft at any airspeed. The entering argument is the change in true outside air temp (TOAT), not gauge temp. The navigator should consult the appropriate aircraft performance manual to determine what compressibility correction must be applied to the gauge reading. If the aircraft pressure altitude changes by more than 200 feet between temperature readings, correct the tabular D2-D1 using a PASTAGRAM solution, a technique not included in this article. Use caution when transitioning from PLOP by temp to PLOP by radar altimetry (or vice versa). Comparing a D1 gained by temp to a D2 gained by radar altimetry is like comparing apples and oranges. Any D2-D1 value gained from dissimilar sources will be erroneous. The navigator must use both methods during the transitioning fix procedure in order to have a readable PLOP at the transition fix and a proper D2-D1 at the subsequent fix.

An MB-4A solution streamlines the PLOP by temp process even more by eliminating the table entirely. Here's how it works. Place your current millibar level over 39,000 and look opposite your observed TOAT change on the distance scale to find D2-D1 on the minutes scale. The ratio solution looks like this:

$$\frac{\text{mb level}}{39{,}000} = \frac{\text{TOAT Change}}{\text{D2-D1}}$$

"D" Difference per TOAT Change
($D_2 - D_1$)

DEGREES TEMPERATURE CHANGE	PRESS. ALT 18M	19M	20M	21M	22M	23M	24M	25M	26M	27M	28M	29M	31M	33M	35M	37M*	39M*
4°	285	303	322	341	360	379	399	419	439	460	481	503	547	593	640	689	740
3°	214	228	241	256	270	284	299	314	330	345	361	377	410	444	480	517	555
2°	143	152	161	170	180	190	199	210	220	230	241	251	273	296	320	344	370
1°	71	76	80	85	90	95	100	105	110	115	120	126	137	148	160	172	185
1/2°	36	38	40	43	45	47	50	52	55	58	60	63	68	74	80	86	92

1. Record temperature at fix positions.
2. Compute the change in True Outside Air Temperature.
3. Enter table with DEGREES TEMPERATURE CHANGE and PRESSURE ALTITUDE.
4. Chart value represents $D_2 - D_1$.
5. The value is POSITIVE if the temperature INCREASED.
   The value is NEGATIVE if the temperature DECREASED.

*These values are representational. The corresponding pressure altitude is above ICAO Standard Day tropopause height.

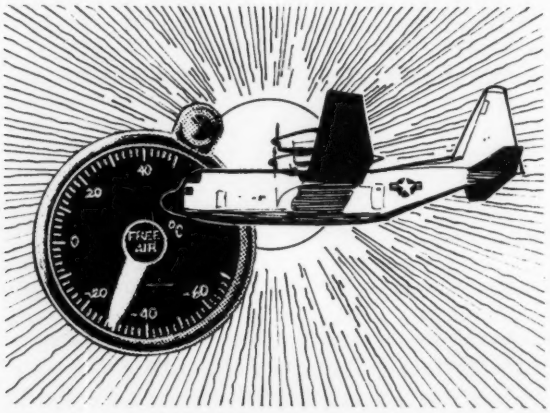
NOTE: PLOP by Temperature is ordinarily not as accurate as PLOP by radar altimetry. This technique should not be used if radar altimeter data is available.

This technique is accurate only when PA is between 20,000 and 34,000 feet. Most navs (myself included) don't have equivalent millibar levels stashed in their heads and use the table rather than deface their beloved computer with a permanent mark over 39,000.

Another related MB-4A technique can give the nav an approximate "D" value during preflight for planning purposes, or in-flight as a crosscheck. Here's how it works. Set PA vs TOAT in the "For Altitude Computations" window and then look opposite PA on the minutes scale to find TA on the distance scale. The difference is approximate "D." (The same reasoning as Equation I.) This technique could yield accurate D2-D1 values if the scalar graduations on the computer were easier to align and read.

Just how accurate is PLOP by temp? To answer that question, let's backtrack one step and consider the PLOP theory. PLOP by radar altimetry assumes that the real wind flows parallel to the isobars (lines of equal pressure) and that the real wind velocity is proportional to the spacing between isobars. Sometimes this condition is true, sometimes it isn't. PLOP by temp assumes that the real wind flows parallel to the isotherms (lines of equal temperature) and that the real wind velocity is proportional to the spacing between isotherms. Again, this condition isn't always true. Both PLOP methods can be adversely affected by surface friction, non-standard lapse rates, intense pressure systems, fronts, and coriolis distortion at lower latitudes. Both PLOP methods, by definition, yield LOPs of varying accuracy.

In late spring 1980, 114 separate ground tests were conducted over a nine-day period on 300 mb and 400 mb CPCs (constant pressure charts) supplied by the Air Force Global Weather Service.



The tests ranged over the entire CONUS as well as portions of the Gulf of Mexico and western Atlantic. Each test measured the distances and slopes between CPC "D" values and isotherms to generate drift information. Drift results from PLOP by temp and PLOP by radar altimetry were compared to the CPC printed winds. Both PLOP methods were found to have the same standard deviation of error in nautical miles. If a nav had flown over the test area during these 114 events, LOPs from both PLOP by temp and PLOP by radar altimetry would have had the same amount of average error (roughly 7 nm with one hour pacing between fixes). The printed winds on CPCs result from a mathematical mixture of observed and computed winds involving lengthy and complex equations. They are much more sophisticated and accurate than the highly simplified PLOP wind assumptions. These tests assumed that both the CPC printed winds and CPC temperatures closely approximated real conditions; assumptions that cannot be proven or refuted without actual flight time and megabucks of JP-4. The only absolute judgment obtainable from these tests is that PLOP by temp and PLOP by radar altimetry appear to have the same theoretical accuracy. Only a prohibitive amount of in-flight testing could determine if one PLOP method was more accurate than the other.

PLOP by temp does have several operational drawbacks. The C-13 temperature indicator in most airlift aircraft is very difficult to read. Reading it to the nearest ½° is almost impossible yet ½° of temperature change can cause up to 10 miles of LOP displacement. Also, many navs still use the C-13 compressibility table originally published in the old AFM 51-40, Vol III and, until recently, published in MACR 55-130. This table was not intended for aircraft flying over 250 KTAS and is very difficult to interpolate to the nearest ½°. These factors can cause significant errors in the resultant PLOP by temp. Easier to read, digital temperature indicators with readouts to the nearest tenth of a degree are available through AFLC and included in some aircraft. Most performance manuals include accurate compressibility tables. MACR 55-130 is scheduled to include an easy to read and interpretable table for use in C-130s. Unless a navigator has access to both, a PLOP by temp seldom will be as accurate as a PLOP by radar altimetry. For these reasons, use PLOP by radar altimetry, if available.

Not all aircraft have avionics that provide radar altitude. Not all nav legs are flown overwater where true altitude can be gained from available avionics. In both cases, PLOP by temp can provide a useful LOP in spite of the cited drawbacks. In some cases, it may be the only LOP available. PLOP by temp performed on overland missions where true altitude is not available can help navigators maintain proficiency at many basic PLOP skills without the frequent (and costly) generation of overwater nav proficiency missions. PLOP by temperature can be a useful technique for many reasons, but only if proper procedure and operating limitations are well known and observed.

A 1969 graduate of the University of Minnesota, St Cloud, Capt Sieverding was commissioned through OTS. After UNT, he was assigned to Clark AB. Next came assignments to the RC-130A photo mapping, the WC-130 at Keesler AFB, and instructor duty at Mather AFB. Capt Sieverding now is a C-130E Simulator Certification Team Member.

THE NAVIGATOR

FIVE-year cumulative index

THE NAVIGATOR has received many requests during the past year for reprinted articles. This 5-year index should assist our readers in finding specific articles on various subjects. If an article of interest appears in an issue you can't locate, write us and we will run a copy. This service is limited to official requests for use in squadron and wing training programs.

	#	year	page
ALLIED AIR FORCES			
Bicentennial Visit to the RAF	3	1976	22
(The) Royal Way	1	1979	5
With the RAF	2	1977	27
BOMBING			
FB-111 Emergency Bombing	3	1980	24
New Trick for an Old Buff	3	1977	10
CELESTIAL NAVIGATION			
Celestial Acceleration Errors	3	1980	27
Celestial Competence	3	1976	21
Celestial Techniques	1	1978	20
Choosing an Assumed Position	2	1977	16
Day Celestial Fixes	1	1977	17
Death of the H-Cut	3	1977	26
Ground Plotting by Sixes	2	1978	14
Improving Your Celestial Accuracy	1	1976	30
LAN-HO	2	1977	19
Lost Air Almanac Procedures	1	1981	10
Manual Space Celestial Positions	2	1977	5
Navigation North of Seventy	2	1976	5
	1	1977	26
(The) Old and Delicate Periscopic Sextant	2	1981	26
Omega and INS Precomps	1	1980	13
On a Dark and Stormy Night	3	1977	24
Sextant and Space Navigation	2	1976	11
Shirt Sleeve Celestial	2	1980	18
Stargazing for Fun	1	1980	17
Star Identification (Part 1)	3	1976	24
(Part 2)	1	1977	23
(Part 3)	2	1977	23
Traversing the Twilight Zone	2	1977	11
Watch Out for Those Motions	3	1979	13
CAREER DEVELOPMENT			
AOC Duty for Navigators	1	1980	30
Career Opportunities in SAC Ops Plans	3	1980	21
Command Day	1	1977	29
General Post Interview	2	1981	13
Is Half a Chance Better?	2	1979	24

	#	year	page
Navigators at Test Pilot School	3	1980	5
Navigators at the Fighter Weapons Center	2	1978	30
Navigator Instructor Duty at the Air Force Academy	1	1981	5
Navigator Management	3	1979	5
SAM Navigator	1	1981	22
ELECTRONIC WARFARE			
Coordinating with NORAD for ECM Clearances	2	1979	21
EB-57	2	1980	12
(The) EF-111A	3	1979	14
F-4G Advanced Wild Weasel	2	1979	16
Spotlight on Senior and Staff EW Training	2	1980	14
Training the Electronic Warfare Officers	3	1977	28
GENERAL INTEREST			
(The) Air Force Reserve Navigator in the "Total Force"	1	1976	23
Busy Observer	3	1978	20
C-130D Ski Hercules	1	1981	19
Computer Flight Plans & Fuel Management	2	1979	28
Eye Over Miami	3	1980	30
Institute of Navigation Superior Achievement Award	3	1980	10
Last Flight	1	1980	28
Management by Objective: A Practical Application	1	1977	19
Navigation - US vs Europe	2	1977	13
(The) Navigator Memorial Park	2	1977	30
NFO on P-3 Orions	1	1981	30
Rendezvous in the "Q"	1	1978	22
(The) Reserve Tanker Navigator	3	1979	22
(The) SAC Navigator -- Our Profession	1	1976	20
Senior Navigator of the Unit	3	1979	19
Statistical Filtering	1	1979	9
(The) Team: Operations and Maintenance	3	1976	29
Time	1	1979	24
USAFA SIN	3	1977	19
Window to the World: EVS and the Navigator	2	1976	25
(The) Write-Up	3	1977	15
GRID AND OVERWATER NAVIGATION			
Close Encounters with Transverse Mercator Graph	3	1980	20
Coast in with Loran C	1	1977	8
Navigation North of Seventy	2	1976	5
	1	1977	26
HISTORY			
Air Navigation - the Early Years	2	1978	5
Berlin Airlift - Flying the Corridor	3	1979	27
Bomber Navigation	3	1978	22
	1	1979	25
F-89	1	1981	14
(The) First Atlantic Crossing	3	1978	16
(The) Grand Old Man of Navigation	2	1978	5
History of MAC	1	1976	15
KC-97	3	1980	15
(The) Lone Eagle	3	1977	12
Navigation History Deserves a Museum	1	1977	14
Project Museum: A First Status Report	2	1976	31
TAC Navigators: Meeting the Challenge	1	1976	10
HUMOR			
Anyone Can Navigate	2	1978	24
High Flight to Pakistan	2	1980	27
My First Overwater Flight	3	1978	24
MISSILES			
SRAM Programming	3	1979	16
NAVIGATION TECHNIQUES			
ADF Magnetic Bearing Rendezvous	2	1980	24
Airpath Turn	2	1976	14
A Decent Descent	2	1981	8
Equal Time Point	3	1978	28
Fine Tuning Your INS	3	1976	16
INS Techniques	2	1981	25
Instrument Airdrop Capability (C-130)	3	1979	24
Low Level Techniques	3	1976	12
Monitoring Approaches	3	1978	7
Pressure Pattern	2	1978	21
Proportional Time Control	2	1979	18
Reverse DR	1	1979	11
(A) Stern Intercept Technique	3	1978	5
Wind Circle Airdrops - A Different Approach	1	1980	8
NAV TOOLS AND AIDS			
(The) AWRS Nav Subsystem	2	1976	20
A Cosmic Computer for the Phantom (AN/ARN-101)	3	1979	10
Computer Case	2	1976	17
Computer Flight Planning	1	1981	26
Nav Calculator Formulas	3	1977	22
(The) Nav Calculator?	2	1979	26
Nav Calculators	3	1977	21
NAVSTAR	3	1977	5
NAVSTAR GPS	1	1981	24
Omega	1	1978	24
(The) Plastic Overlay Trick	1	1979	12
Programmable Calculator as a Navigation Tool	1	1980	23
Satellite Navigation - Playing the North Star	1	1976	27
Sextant and Space Navigation	2	1976	11
Time Distance Graph	1	1977	11
What's a Ring Laser Gyro?	1	1979	18
Where Will we be Without TACAN	3	1978	11
PROFESSIONAL DEVELOPMENT			
A Leadership Style	3	1977	14
(The) Generals	2	1980	9
(The) Navigator/An In-Flight Commander	2	1976	22
Navigator Retention	2	1980	5
(The) Second Annual USAF Navigation Symposium	3	1979	26
The 1980 USAF Navigator Symposium	2	1981	20
RADAR			
RF-4C Radar Predictions	3	1980	12
Radar Trail	1	1978	15
USAF's Electronically Agile Radar for Strategic Bombers	2	1979	14
TRAINING			
B-52 EWO to UNT Instructor	1	1978	10
Course Training Standard Conference - 1975	1	1976	29
Electronic Warfare Refresher Course	2	1976	23
Getting Hooked on Ground Missions	1	1979	22
Instructor Training School	1	1980	10
Interservice Navigation Training at Mather	2	1976	27
ISD and the Navigator	2	1978	9
(The) New Concept in UNT	1	1979	14
(The) Marines are Looking for a Few Good Navigators	2	1976	29
SAC Route & Target Development	2	1981	5
Spotlight on Senior and Staff EW Training	3	1977	28
Training the Electronic Warfare Officers	3	1977	28
What's a Tweet?	2	1978	16
WEAPONS SYSTEMS			
A-6 Intruder	2	1981	28
A Test Nav Looks at the B-1	3	1976	5
AWACS - Where the Action Is!	1	1978	12
B-52	2	1981	22
(The) EF-111A	3	1979	14
Everything You've Always Wanted to Know About a U-2 Navigator	1	1978	5
F-4G Advanced Wild Weasel	2	1979	16
F-16 Navigator - Flying in the Electric Jet	2	1980	20
Gunship	3	1978	25
KC-10A	1	1979	16
SR-71 - The Fabulous Blackbird	1	1977	5
WEAPONS SYSTEMS OFFICERS			
Air Superiority GIB	2	1976	18
Scramble!	1	1980	5
(The) TAC WSO	3	1978	13
Weapons System Officer Management; My End of Tour Report	1	1978	26
WEATHER			
Air Weather Service	2	1979	9
Nav Typhoon Chaser	2	1978	20
Weather and War	2	1979	5
Weather Penetration or Weather Avoidance?	2	1979	11

HOW TO SUBMIT AN ARTICLE FOR THE NAVIGATOR MAGAZINE

Most of the material published in THE NAVIGATOR has been voluntarily contributed by navigators throughout the Air Force. Why not do your part toward advancing the profession? Make your ideas and experiences available to your fellow navigators by submitting them for worldwide publication in THE NAVIGATOR.

SUBJECTS: Any article relating to air navigation or the navigator career field is appropriate; therefore, an almost infinite variety of subjects is available. The choice, of course, will depend upon your particular interests. Here are some general areas to consider:

1. Informative operational experiences.
2. Improved procedures, techniques, and equipment.
3. New or proposed navigational concepts and equipment.
4. Analytical suggestions to improve the career field.

Articles should not be reprints, material readily accessible to Air Force navigators, or verbatim restatements of AFRs, AFMs, TOs, etc. Of course, classified information cannot be used.

REVIEW AND CLEARANCE: The article *must* be formally cleared for publication. This can best be accomplished through your base Public Affairs Office, who will insure that your manuscript is properly reviewed and cleared prior to release. SAC personnel should refer to SACR 5-3 for article submission procedures. Provide THE NAVIGATOR with a copy of the clearance letter attached to your manuscript.

FORMAT: Your manuscript may be prose, poetry, or cartoon with a narrative and/or technical writing style. Articles should be typed, double spaced and include a suggested title and the author's grade, name, and organizational address. Only one copy is required. Include a short biographical sketch and photograph of the author in Class A uniform.

SUPPORTIVE MATERIAL: The old saying about a picture being worth 1,000 words still applies. Carefully consider whether your manuscript would be enhanced by illustrative material. Diagrams, charts, photographs (preferably glossy black and whites), etc, are often the key to putting an idea across.

Put your improvement, innovation, humorous comment, or career-related suggestion down on paper and send it along. Our address is:

THE NAVIGATOR Magazine
323 FTW/DOTN
Mather AFB CA 95655

HOW TO OBTAIN THE NAVIGATOR MAGAZINE

In response to the many phone calls and questions received regarding how to "get on the distribution list for THE NAVIGATOR," the following instructions are provided:

Published triannually, THE NAVIGATOR (Air Force Publication 50-3) can be obtained through administrative channels. Have your Customer Account Representative (CAR) submit an AF Form 764a to the Publications Distribution Office (PDO) serving your organization. The authorized quantity is one copy per two navigators. Individual/private subscriptions can be obtained using the form at the bottom of the page. THE NAVIGATOR Magazine Office cannot initiate, control, or adjust the distribution of the magazine.

CHANGE OF ADDRESS FORM **AFRP 50-3**

NEW ADDRESS

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE | (or) COUNTRY

ATTACH LAST SUBSCRIPTION LABEL HERE

MAIL FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

☆ U.S. GOVERNMENT PRINTING OFFICE 1981-587-034/2

SUBSCRIPTION ORDER FORM **AFRP 50-3**

ENTER MY SUBSCRIPTION TO: THE NAVIGATOR MAGAZINE

Domestic: $ 7.50 Foreign: $ 9.40

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE | (or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

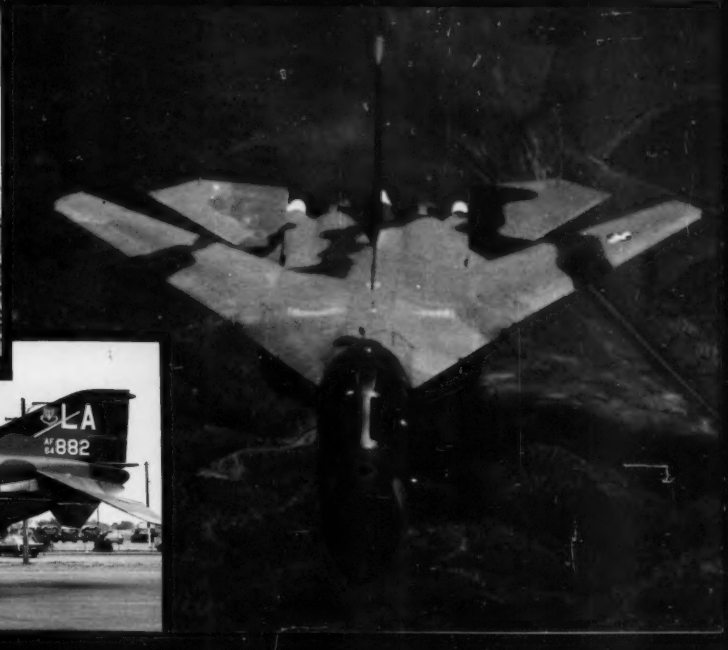
☐ Charge to my Deposit Account No. .....

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

USAF

CC
093

BA
383



LA
882